CLAIMS

1. A gait-locomotor apparatus that is wore on a disabled user, said gait-locomotor apparatus comprising:

a brace having a plurality of jointed segments, said brace adapted to fit the lower body of the disabled user;

propulsion means adapted to provide relative movement between said plurality of jointed segments;

at least one sensor adapted to monitor the angular position of at least one of said plurality of jointed segments;

a control unit adapted to supervise said propulsion means and to receive feedback information from said at least one sensor so as to facilitate said brace to perform walking patterns;

whereby the disabled user that wears said gait-locomotor apparatus is able to steadily stand in a stance position supported by said brace, and is able to walk in various walking patterns using said control unit.

2. The gait-locomotor apparatus as claimed in Claim 1, wherein said brace comprises a torso brace and a pelvis brace adapted to fit the user's trunk, two thigh braces adapted to fit the user's thighs, and two leg braces adapted to fit the user's legs and feet.

3. The gait-locomotor apparatus as claimed in Claim 1, wherein stabilizing shoes are provided and are attached to the brace, said stabilizing shoes are adapted to increase the lateral stability.

4. The gait-locomotor apparatus as claimed in Claim 3, wherein said stabilizing shoes are adapted to maintain a side lean.

5. The gait-locomotor apparatus as claimed in Claim 3, wherein said stabilizing shoes are provided with a rounded bottom.

6. The gait-locomotor apparatus as claimed in Claim 1, wherein said brace is provided with two side crutches adapted to provide direct support to the user.

7. The gait-locomotor apparatus as claimed in Claim 6, wherein said two side crutches are retractable so as to facilitate height adjustments.

8. The gait-locomotor apparatus as claimed in Claim 7, wherein at least one of said two side crutches comprises at least two members that are telescopically connected so as to adjust the side crutch length.

9. The gait-locomotor apparatus as claimed in Claim 6, wherein each of said two side crutches is provided with a handle that facilitates the user to grasp the crutches.

10. The gait-locomotor apparatus as claimed in Claim 6, wherein said two side crutches are provided with a motorizes system that is adapted to actuate the side crutches and wherein said motorized system is electrically connected to said control unit.

11. The gait-locomotor apparatus as claimed in Claim 1, wherein said propulsion means are positioned in or proximal to articulations between the jointed segments of said brace.

12. The gait-locomotor apparatus as claimed in Claim 1, wherein said propulsion means are linear motors.

13. The gait-locomotor apparatus as claimed in Claim 1, wherein two of the motors are adjacent to the user's hip.

14. The gait-locomotor apparatus as claimed in Claim 1, wherein two of the motors are adjacent to the user's knees.

15. The gait-locomotor apparatus as claimed in Claim 14, wherein at least one of the linear motors is provided with a stator provided with a forcer, said stator is attached to one of the jointed segments, and wherein said forcer is coupled to a lever that is attached to the adjoining segment.

16. The gait-locomotor apparatus as claimed in Claim 15, wherein said lever having a laterally protruding portion, and wherein said forcer is coupled to said portion.

17. The gait-locomotor apparatus as claimed in Claim 15, wherein said stator is pivotally connected to the jointed segment.

18. The gait-locomotor apparatus as claimed in Claim 1, wherein said propulsion means is a thrust force motor having a linear motor provided with gearing ability, said linear motor is attached to one of the jointed segments, and wherein a forcer of said linear motor is connected to a belt having two ends, said belt circles about a wheel and is further coupled to a lever attached to the adjoining articulated segment.

19. The gait-locomotor apparatus as claimed in Claim 18, wherein said lever is provided with two opposite lateral protrusions, and wherein each of the two ends of said belt is connected to one of the lateral protrusions of said lever.

20. The gait-locomotor apparatus as claimed in Claim 18, wherein said lever is a cogwheel attached in an articulation between jointed segments.

21. The gait-locomotion apparatus as claimed in Claim 1, wherein said propulsion means comprises a thrust force motor in which a linear motor having gearing ability is attached to a jointed segment between two articulations, and wherein a stator of said linear motor is provided with two adjacent wheels, said stator is provided with a first forcer coupled to a belt, said belt circles about one of the wheels and circles a cogwheel that is attached adjacent to one of the articulations, and wherein said stator is provided with a second forcer coupled to another belt that circles about the other wheel and circles another cogwheel that is attached adjacent to the other articulation.

22. The gait-locomotor apparatus as claimed in Claim 1, wherein said propulsion means comprises an air muscle actuator.

23. The gait-locomotor apparatus as claimed in Claim 1, wherein said propulsion means comprises a rotary motor.

24. The gait-locomotor apparatus as claimed in Claim 23, wherein said rotary motor is positioned in an articulation between the jointed segments of said brace.

25. The gait-locomotor apparatus as claimed in Claim 24, further comprising a plurality of interacting cogwheels, at least one of the cogwheels is connected by a movable belt to another wheel so as to provide relative movement between the jointed segments.

26. The gait-locomotor apparatus as claimed in Claim 25, wherein said two interacting cogwheels are concentric.

27. The gait-locomotor apparatus as claimed in Claim 1, wherein said at least one sensor is a tilt sensor.

28. The gait-locomotor apparatus as claimed in Claim 27, wherein a goniometer is attached to articulations between the jointed segments of said brace in order to measure the articulation angle.

29. The gait-locomotor apparatus as claimed in Claim 1, wherein said at least one sensor is an acceleration sensor.

30. The gait-locomotor apparatus as claimed in Claim 29, wherein said at least one sensor is an accelerometer.

31. The gait-locomotor apparatus as claimed in Claim 1, wherein said feedback information is angles of articulation between the jointed segments of said brace.

32. The gait-locomotor apparatus as claimed in Claim 1, wherein said feedback information is accelerations of the user's body parts.

33. The gait-locomotor apparatus as claimed in Claim 1, wherein said feedback information is angular velocities.

34. The gait-locomotor apparatus as claimed in Claim 1, wherein a processor is incorporated in said control unit, said processor adapted to execute motion control algorithms.

35. The gait-locomotor apparatus as claimed in Claim 34, wherein said algorithms comprises commands dictating the angles between the jointed segments and the position of the jointed segments so as to perform predetermined modes of operation on said brace.

36. The gait-locomotor apparatus as claimed in Claim 35, wherein said modes of operation are selected from the group consisting of standing mode, gait mode, climbing mode, descending mode, lie-sit transition mode, sit-stance transition mode, stance-gait transition mode, training mode, learning mode or a combination thereof.

37. The gait-locomotor apparatus as claimed in Claim 35, wherein at least one of said modes of operation is initiated by exceeding a threshold value in the angular position of at least one of the jointed segments.

38. The gait-locomotor apparatus as claimed in Claims 36, wherein at least one of said modes of operation is initiated by receiving a signal monitored by at least one of said sensors, said signal exceeds a threshold value in the tilt angle of the user's torso.

39. The gait-locomotor apparatus as claimed in Claim 1, wherein said control unit is communicating with said propulsion means through power drivers.

40. The gait-locomotor apparatus as claimed in Claim 1, wherein said control unit is communicating with a man-machine interface adapted to receive commands from the user.

41. The gait-locomotor apparatus as claimed in Claim 1, wherein said at least one sensor is communicating with said control unit through feedback interfaces.

42. The gait-locomotor apparatus as claimed in Claim 1, wherein said gait-locomotor apparatus further comprises a safety unit and a built-in test unit.

43. The gait-locomotor apparatus as claimed in Claim 42, wherein said safety unit is communicating with said control unit.

44. The gait-locomotor apparatus as claimed in Claim 42, wherein said safety unit is communicating with said at least one sensor.

45. The gait-locomotor apparatus as claimed in Claim 1, wherein said gait-locomotor apparatus further comprises a power unit.

46. The gait-locomotor apparatus as claimed in Claim 1, wherein said at least one sensor provides a warning signal.

47. The gait-locomotor apparatus as claimed in Claim 46 or 45, wherein a warning signal indicates the status of said battery.

48. The gait-locomotor apparatus as claimed in Claim 46, wherein a warning signal indicates currents in said propulsion means.

49. The gait-locomotor apparatus as claimed in Claim 1, wherein said gait-locomotor apparatus further comprises at least one temperature sensor.

50. The gait-locomotor apparatus as claimed in Claim 49, wherein said gait-locomotor apparatus further comprises overheat protection.

51. The gait-locomotor apparatus as claimed in Claim 50, wherein said temperature is monitored in said propulsion means.

52. The gait-locomotor apparatus as claimed in Claim 50, wherein said temperature is monitored in said control unit.

53. The gait-locomotor apparatus as claimed in Claim 1, wherein said gait-locomotor apparatus further comprises a functional electrical stimulation (FES).

54. The gait-locomotor apparatus as claimed in Claim 1, wherein said gait-locomotor apparatus further comprises electrodes, said electrodes are electrically communicating with a signal generator.

55. The gait-locomotor apparatus as claimed in Claim 54, wherein said signal generator is communicating with said control unit.

56. The gait-locomotor apparatus as claimed in Claim 54, wherein said control unit further comprises commands dictating the electrical signal that is transferred by the electrodes.

57. The gait-locomotor apparatus as claimed in Claim 53, wherein said control unit further comprises command that activate the FES.

58. A method for facilitating walking by a disabled user, said method comprises:

providing a gait-locomotor apparatus comprising:

a brace having a plurality of jointed segments, said brace adapted to fit the lower body of the disabled user;

propulsion means adapted to provide relative movement between said plurality of jointed segments;

at least one sensor adapted to monitor the angular position of at least one of said plurality of jointed segments;

a control unit adapted to supervise said propulsion means and to receive feedback information from said at least one sensor so as to facilitate said brace to perform walking patterns;

wearing said brace on the user's lower body parts;

tilting the user's upper body in order to initiate a response in said control unit so as to actuate said propulsion means and to cause said brace to perform walking patterns.

59. A method as claimed in Claim 58, wherein said method further comprises commanding said control unit to stop operation or to change actuation;

60. A method as claimed in Claim 58, wherein said method further comprises:

providing electrodes;

providing signal generator, said signal generator is electrically communicating with said electrodes;

attaching said electrodes to the user;

commanding said control unit to actuate said signal generator.

61. A gait-locomotor apparatus adapted to be worn on a disabled user, said gait-locomotor apparatus comprising:

a brace having a plurality of jointed segments, said brace adapted to fit the body of a disabled user;

a plurality of actuators adapted to affect relative movement between said plurality of jointed segments;

at least one sensor adapted to monitor the angular relationship between at least two of said plurality of jointed segments;

a control unit adapted to activate at least one of said actuators and to receive feedback information from said sensor so as to facilitate said brace to perform walking patterns, said control unit being responsive to inclination of the user torso to initiate or control walking.